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AN ALTERNATIVE CUL-DE-SAC DESIGN

Alberta
DEPARTMENT OF HOUSING

AN ALTERNATIVE CUL-DE-SAC DESIGN

September 1983

Prepared By:

REID, CROWTHER AND PARTNERS LIMITED
Consulting Engineers and Planners

The views and conclusions expressed and the recommendations made in this report are entirely those of the authors and should not be construed as expressing the opinions of the Alberta Department of Housing.

With funding provided by
Alberta Department of Housing

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FOREWORD

This study was made possible with funding provided by the Innovative Housing Grants Program of the Alberta Department of Housing. Originally conceived in 1978, the Program is intended to encourage, sponsor, and assist research and development in the fields of housing, site and subdivision design, energy conservation, site servicing and urban development. Generally, the aims of research funded by the Innovative Housing Grants Program are to reduce housing costs, increase the supply of appropriate housing or improve the utility or performance of dwelling units or subdivisions.

The main purpose of funding these studies is to examine the current issues in the field of housing and to develop innovations which offer improvements. Comments and suggestions regarding the information contained in these reports are welcome.

Innovative ideas come from a wide variety of applicants such as builders, developers, consulting firms, industry associations, municipal governments, educational institutions, non-profit groups and individuals. As the type of project and level of resources vary from applicant to applicant, the resulting documents are also varied.

Where possible the Department encourages the dissemination of study results under a standard cover and in a uniform format. This study, An Alternative Cul-de-Sac Design , was completed in October 1982 and subsequently released under a different cover.

Please send comments and suggestions or requests for further information to:

Innovative Housing Grants Program
Fourth Floor
10050 - 112 Street
Edmonton, Alberta
T5K 2J1

Alberta Department of Housing
September 1983

Alberta
DEPARTMENT OF HOUSING

Innovative Housing Grants Program

AN ALTERNATIVE CUL-DE-SAC DESIGN

Reid Crowther and Partners Ltd.

Introduction

This research study developed an alternative cul-de-sac design that goes beyond the traditional approach to cul-de-sac's. To date, cul-de-sac's for the most part have been circular (predicated by turning radii for vehicles) and lots have been orientated to radiate out from this circumference. This research looks at cul-de-sac's as a means to achieve better urban design by obtaining more lots adjacent to open areas, access to focal points in the community, improved servicing and lower development costs.

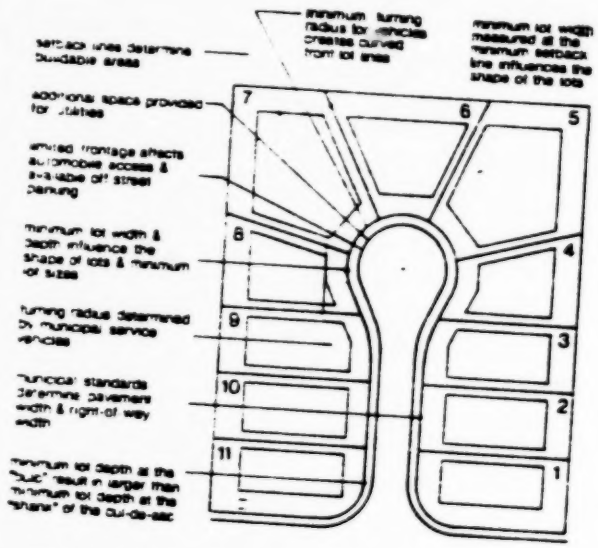
minimum turning radius for vehicles creates curved front lot lines
minimum lot width measured at the minimum setback line influences the shape of the lots
set-back lines determine buildable areas
additional space provided for utilities
limited frontage affects automobile access & available off street parking
minimum lot width & depth influence the shape of lots & minimum lot sizes
turning radius determined by municipal service vehicles
municipal standards determine pavement width & right-of way width
minimum lot depth at the "bulb" result in larger than minimum lot depth at the "throat" of the cul-de-sac
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Figure 1. A Traditional Cul-de-sac Design

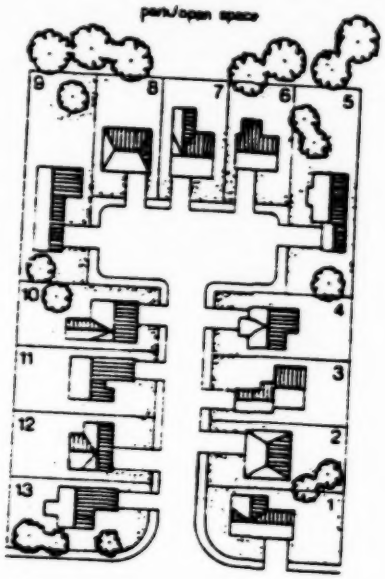

Figure 2. An Alternative Cul-de-Sac Design

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Order No.: 8204231
IIB
Completed: Oct., 1982
ISBN: 0-88654-021-6 -
Report: 39 Pages

Table 1. Comparison of Conventional and Alternative Cul-de-Sac Designs

	Total Servicing Cost Per Lot	
	Conventional (11 Lots)	Alternative (13 Lots)
Per lot costs (within the cul-de-sac)	$5,160.00	$6,141.00
Per lot costs for 50% of the adjacent roadway and services	$2,526.00	$1,937.00
Total (per lot)	$7,686.00	$8,078.00

An Alternative

In the alternative design approach total servicing costs increased by about 5 per cent. However, the number of lots increased by 18 per cent with a 66 per cent increase in the area of premium lots at the head of the cul-de-sac. If the application of the alternative is considered fora larger area, this design has the potential to reduce total lot costs by up to 10 per cent for areas using cul-de-sacs.

Conclusions

Under certain circumstances, the Alternative Cul-de-Sac Design permits better design, better use of land, better access to potential amenity areas, higher density and the potential for a better return on investment. Because of the opportunity to reduce development costs, this system could provide more affordable housing.

40,632-4(a)

October 22, 1982

Alberta Housing & Public Works
4th Floor, One Twelve Professional Centre
10050 - 112 Street
EDMONTON, Alberta
T5K 1L9

Attention: Mr. Robert Sloat

Dear Sirs:

Alternative Cul-de-sac Design

We are pleased to submit this report entitled "An Alternative Cul-de-sac Design".

Phase I examines the current design of a cul-de-sac and identifies briefly its positive and negative features.

Phase II examines an alternative to the conventional cul-de-sac and then compares it to the conventional design.

Phase III illustrates the use of the conventional and alternative design in a conceptual subdivision design exercise.

We trust you will find this report interesting and useful and that subdivision designers, developers and approval authorities will utilize the alternative to improve the cost of shelter and provide an alternative living environment.

REID, CROWTHER & PARTNERS LIMITED

H. K. Driver, M.C.I.P.
Manager, Planning Division

HKD/dd

Enclosure

ACKNOWLEDGEMENTS

- Mr. Robert Sloat, Alberta Housing & Public Works
- Mr. Brett Halford, Melcor Developments Limited
- Mr. Robert Thomas, Melcor Homes Limited
- Mr. Jim Leguilloux, Melcor Homes Limited

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October, 1982

1. INTRODUCTION

This study examines the conventional cul-de-sac design which represents only one element of a subdivision design. The cul-de-sac has been widely used by subdivision designers to create a secluded and attractive street within the urban environment. However, there are some inefficiencies in the cul-de-sac design which could be improved upon and incorporated into an alternative design. This brief review covers the major design constraints and advantages of the cul-de-sac to demonstrate its desirable features as well as identify areas for improvement. The essential followup to this exercise is to present an alternative design to the conventional cul-de-sac which will provide not an alternative per se, but an alternative set of advantages (and disadvantages) which may allow more flexibility in design, higher density, and more efficient servicing and economics.

The essential point that is being made is that Subdivision Approving Agencies tend to review a subdivision with cul-de-sacs only in a traditional light, i.e., the cul-de-sac is circular and has lots radiating out from its circumference. The collective wisdom is that this allows for vehicles to turn around and exit from a dead-end street. This study views the cul-de-sac as a tool to achieve other ends, i.e., more lots, better urban design, access to other land uses, improved servicing, or better development costs. To this end it may be more advantageous to sacrifice traffic efficiency.

The study has been divided into three phases. They are:

Phase I - To examine the conventional cul-de-sac design to determine its inefficiencies and merits and to identify areas of improvement, and to review municipal servicing and design requirements.

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Phase II - To present an alternative design and examine land requirements, servicing concepts and servicing costs posed by this alternative, and to develop guidelines for the alternative cul-de-sac design.

Phase III - To prepare two conceptual designs using both the conventional and alternative designs in order to demonstrate variations of each and compare the use of both designs.

To faciliate consistency and a more accurate assessment, the bylaw requirements and engineering design standards for the Town of Spruce Grove have been used for the purposes of this analysis. Although specific setbacks and design standards will vary in other municipalities, the concepts and conclusions discussed in this study should still apply.

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2. PHASE I - REVIEW OF THE CONVENTIONAL CUL-DE-SAC

2.1 Desirable Qualities

Homeowners generally perceive the cul-de-sac as a desirable and "livable" street which is particularly well suited to individuals and families preferring a relatively quiet living environment. The cul-de-sac prevents the intrusion of through traffic. The semi-circular arrangement of lots and housing gives the feeling of privacy, security, and a sense of community. The larger pie-shaped lots are attractive to homeowners who prefer a larger yard for outdoor activities. In some instances, an individual cul-de-sac or groups of cul-de-sacs have been placed along amenity areas such as ravines, rivers, lakes and golf courses to combine the element of privacy and seclusion of the cul-de-sac with the benefitting view and access to public or semi-public amenity areas. It has also been found that the lots on a cul-de-sac, especially those at the extreme end, are the first to sell in a new subdivision, usually at slightly higher values than other lots in the subdivision. Those backing onto a park or other open space are usually more desired than even regular cul-de-sac lots. Fig. 1 illustrates a traditionally designed cul-de-sac.

2.2 Factors Affecting Design of the Cul-de-sac

It is beyond the scope of this study to vigorously pursue all of the factors influencing design as they relate to the cul-de-sac or to examine any of these elements in great detail. However, the basic elements influencing the design which require some consideration to meet the objectives of this study are; land use bylaw requirements, municipal design standards, maintenance requirements, house design, and site planning.

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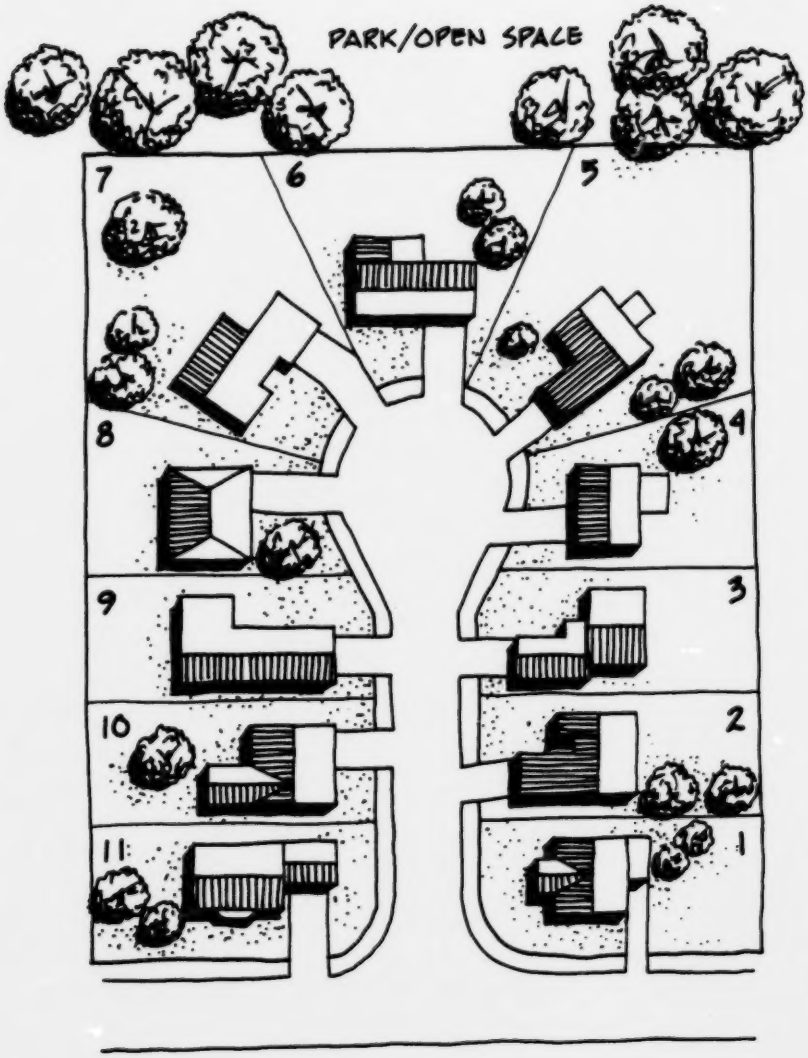

Figure 1

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2.2.1 Land Use Bylaw and Engineering Design Standards

Land use bylaw requirements place very precise controls on the size and shape of lots, and the setback distance. They control the size and location of the house and they define the buildable area on the lot. Perhaps a more important generator of the current cul-de-sac design is the perceived necessity to create a turning-circle for all but the very large vehicles. The result is that municipal design standards define the width of the right-of-way and turning radii for efficient movement of cars, emergency service and road maintenance vehicles. The standards also define the location and spacing of municipal and utility services.

Fig. 2 - Factors Affecting Design of the Cul-de-sac, shows in graphic form where the bylaw requirements and municipal design standards influence the design of the cul-de-sac and placement of houses. (References should be made to the Town of Spruce Grove, Land Use Bylaw No. 531).

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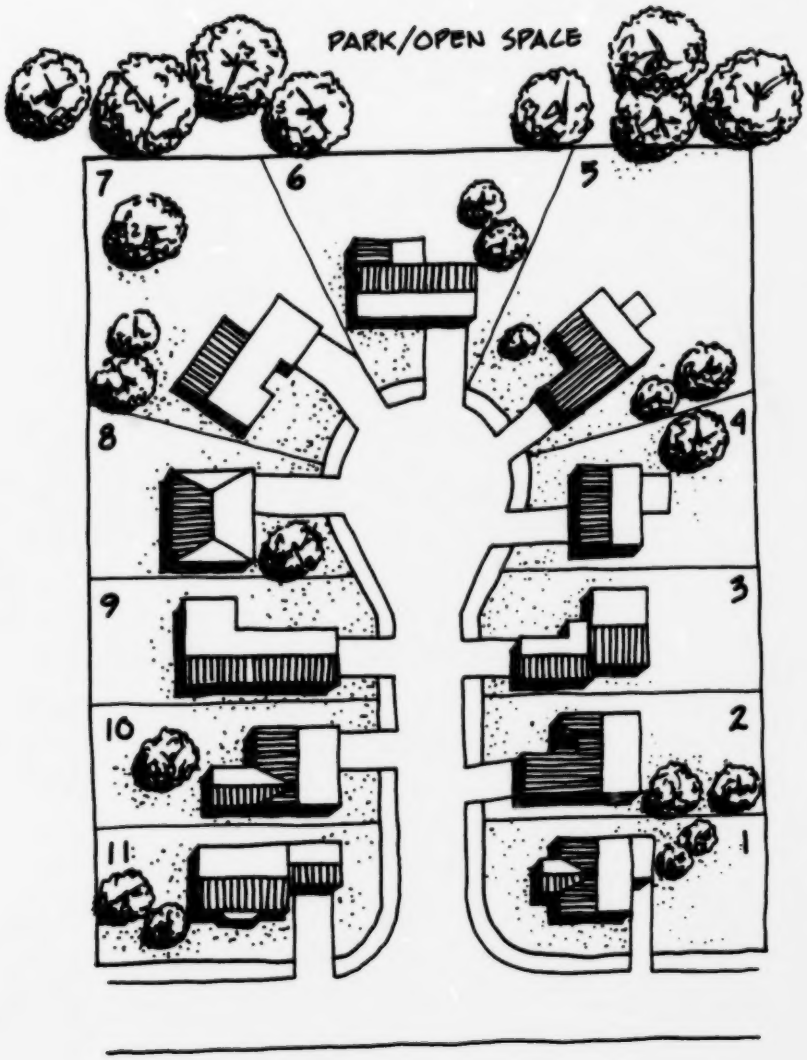

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FACTORS AFFECTING THE DESIGN OF A CUL-DE-SAC

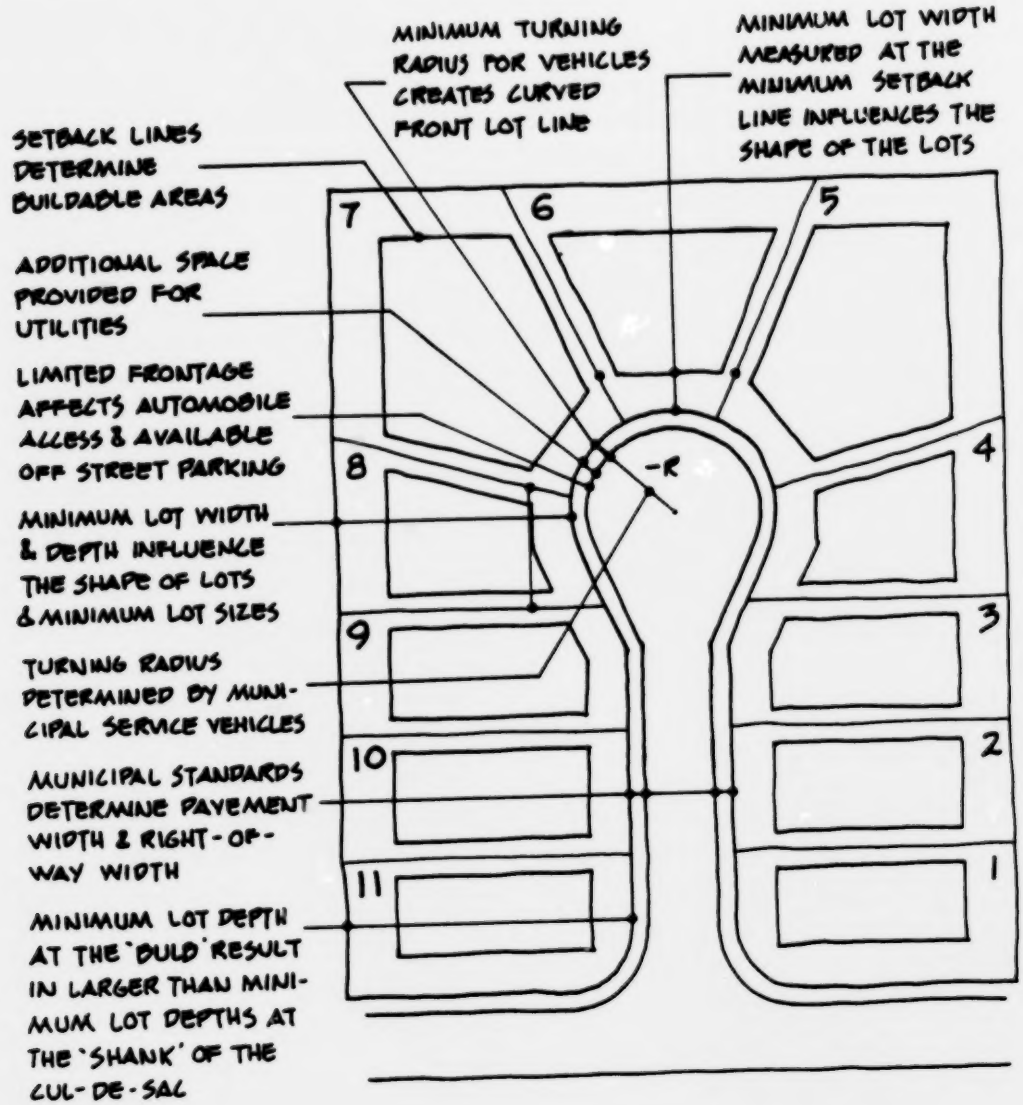
MINIMUM TURNING RADIUS FOR VEHICLES CREATES CURVED FRONT LOT LINE
MINIMUM LOT WIDTH MEASURED AT THE MINIMUM SETBACK LINE INFLUENCES THE SHAPE OF THE LOTS
SETBACK LINES DETERMINE BUILDABLE AREAS
ADDITIONAL SPACE PROVIDED FOR UTILITIES
LIMITED FRONTAGE AFFECTS AUTOMOBILE ACCESS & AVAILABLE OFF STREET PARKING
MINIMUM LOT WIDTH & DEPTH INFLUENCE THE SHAPE OF LOTS & MINIMUM LOT SIZES
TURNING RADIUS DETERMINED BY MUNICIPAL SERVICE VEHICLES
MUNICIPAL STANDARDS DETERMINE PAVEMENT WIDTH & RIGHT-OF-WAY WIDTH
MINIMUM LOT DEPTH AT THE 'BULD' RESULT IN LARGER THAN MINIMUM LOT DEPTHS AT THE 'SHANK' OF THE CUL-DE-SAC
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Figure 2

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2.2.2 House Design and Site Planning

Houses are designed to suit a family's immediate and future needs. They are generally designed to be sited on a particular type of lot and for a specific orientation. There are as a result, countless shapes and sizes of houses designed under these conditions. However, two basic house plans represent a wide variety of styles, floor plans and building heights. These two plans are illustrated on the Fig. 3 and are used to illustrate site planning problems as they may occur in cul-de-sacs.

THE L-SHAPED HOUSE, WITH A PROTRUDING ATTACHED GARAGE OR LIVING SPACE, AND

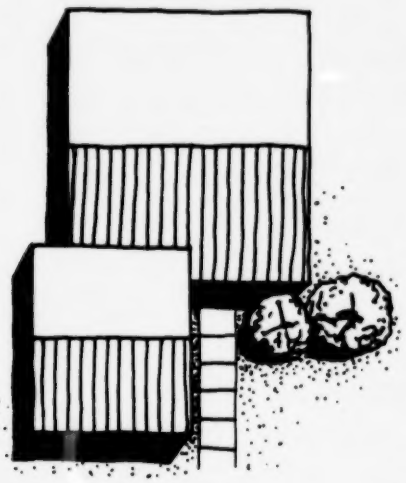
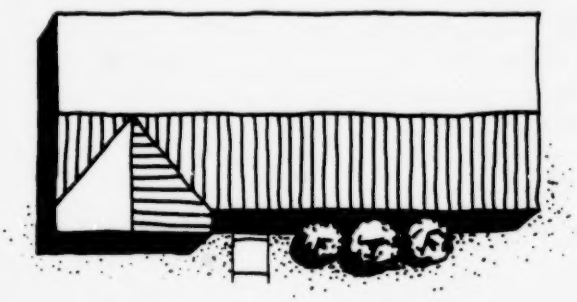


Figure 3

THE RECTANGULAR-SHAPED HOUSE

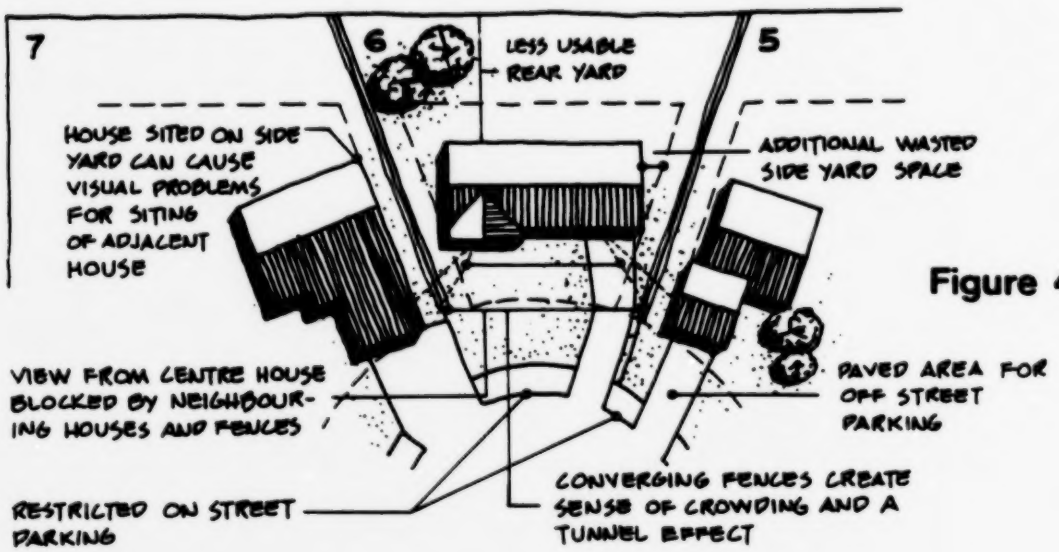


With careful site planning and forethought, a house plan that suits a particular family's needs would be designed for and located on an appropriate lot. However, as is more often the case, problems arise when houses and lots are not matched properly or when houses on adjacent lots do not complement each other, i.e., private areas are overlooked, 'noisy' rooms in one house are adjacent to 'quiet' rooms in the other.

House selection and siting problems tend to become more acute when they occur on pie-shaped lots and on narrow lots. In these circumstances, there is a great need for careful design of both the house and its location on the lot.

2.2.3 Common Siting Problems Within the Cul-de-sac

Frequently a wide house situated on a pie-shaped lot requires that the house be sited further back on the lot due to side yard setback requirements. When houses are placed on adjacent pie-shaped lots and one house is sited on the minimum setback line, several undesirable situations occur as shown on the following sketches. Regardless of how a house is sited on a pie-shaped lot, inefficient space will always occur in the side yard areas. Shallow back yards could further limit subsequent modification to the house or yard plans.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LESS USABLE REAR YARD
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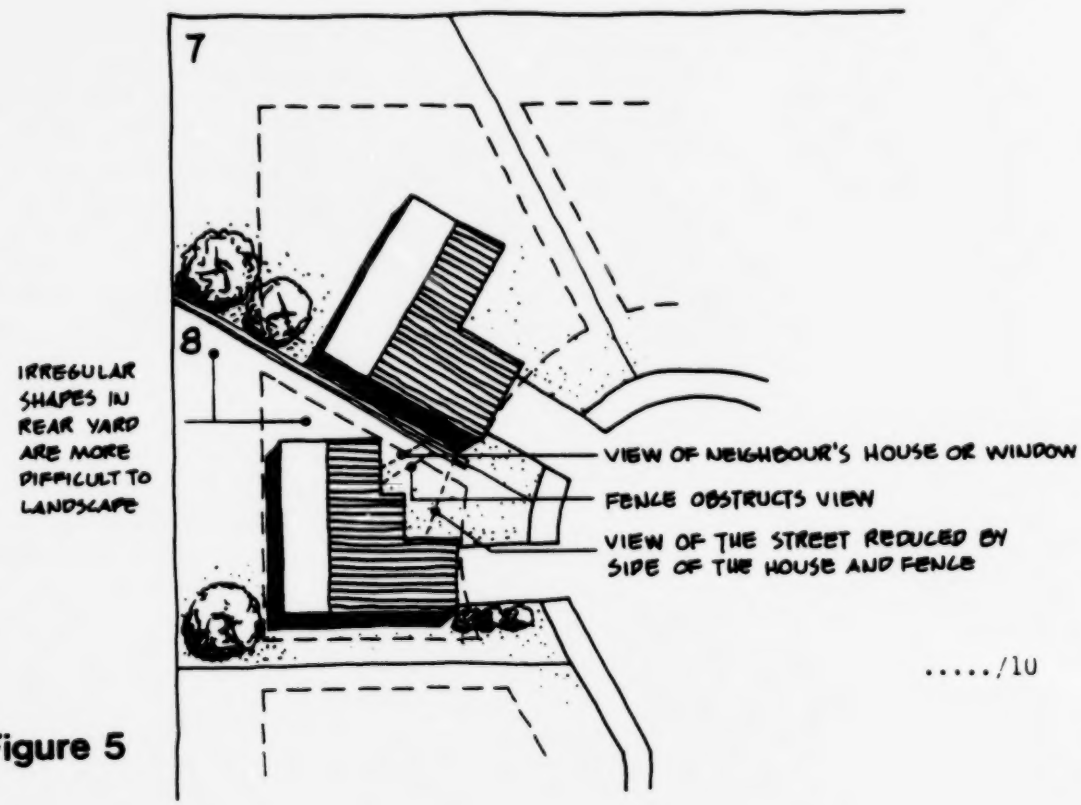
HOUSE SITED ON SIDE YARD CAN CAUSE VISUAL PROBLEMS FOR SITING OF ADJACENT HOUSE
ADDITIONAL WASTED SIDE YARD SPACE
VIEW FROM CENTRE HOUSE BLOCKED BY NEIGHBOURING HOUSES AND FENCES
PAVED AREA FOR OFF STREET PARKING
RESTRICTED ON STREET PARKING
CONVERGING FENCES CREATE SENSE OF CROWDING AND A TUNNEL EFFECT

Figure 4

The problems are compounded if adjacent houses are sited without review of adjacent house sitings.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IRREGULAR SHAPES IN REAR YARD ARE MORE DIFFICULT TO LANDSCAPE
VIEW OF NEIGHBOUR'S HOUSE OR WINDOW
FENCE OBSTRUCTS VIEW
VIEW OF THE STREET REDUCED BY SIDE OF THE HOUSE AND FENCE

Figure 5

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Finally, when a cul-de-sac is placed adjacent to a park or positioned to take advantage of a scenic view, only two or three lots at most have access to that amenity or view. It would be desirable to increase the number of lots backing onto that amenity by modifying the lot plan at the cul-de-sac head. In addition, if houses are sited parallel to the front lot line, the houses on some pie-shaped lots tend to be oriented away from the amenity as shown in Fig. 6.

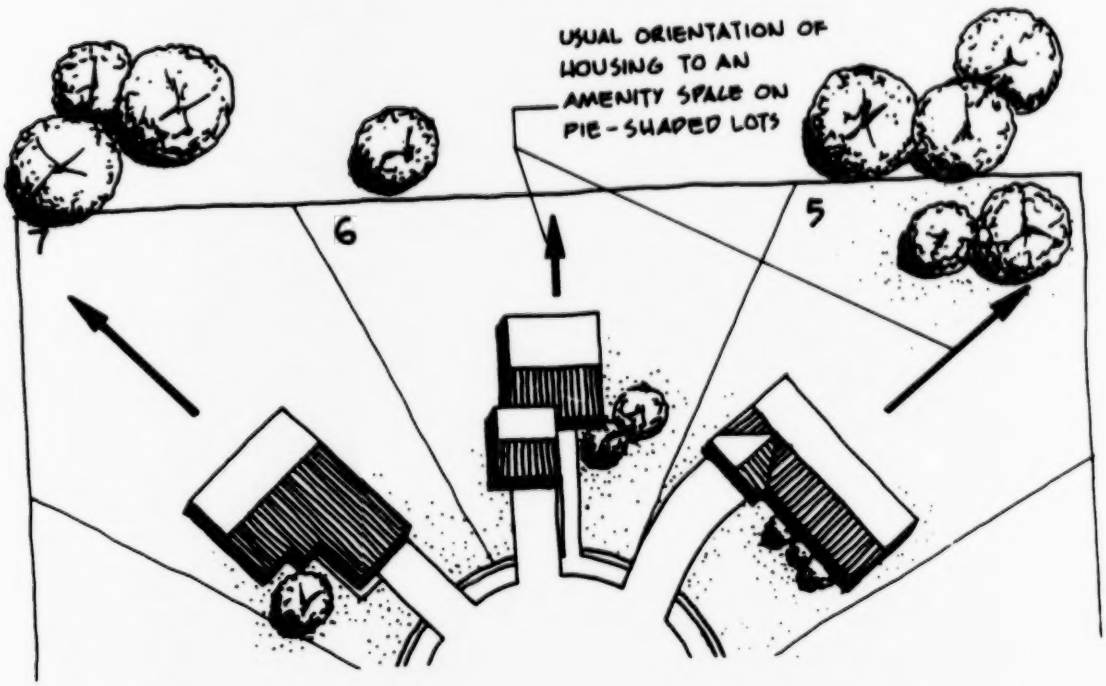

Figure 6

2.3 Municipal Servicing and Maintenance

Municipal servicing standards for a cul-de-sac are generally the same as for other residential streets. However, there are some minor differences. There may not be a storm sewer in the right-of-way if the cul-de-sac is short and the topography is suitable, because stormwater can be drained via gutters, to a catchbasin at the intersection. Secondly, cul-de-sacs generally do not have sidewalks, only curbs and gutters. Thirdly, the water lines are dead-ended and not looped as in other parts of the subdivision. The dead-end water lines result in reduced fire flow, increased sedimentation and are subject to freezing. Finally, maintenance vehicles such as garbage trucks, street sweepers, front-end loaders and trucks used for snow removal can usually maneuver safely within the paved area of the cul-de-sac. Larger vehicles have difficulty and must back out of the cul-de-sac.

A standard municipal servicing concept for a cul-de-sac is illustrated in Fig. 7 - Municipal Servicing.

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MUNICIPAL SERVICING

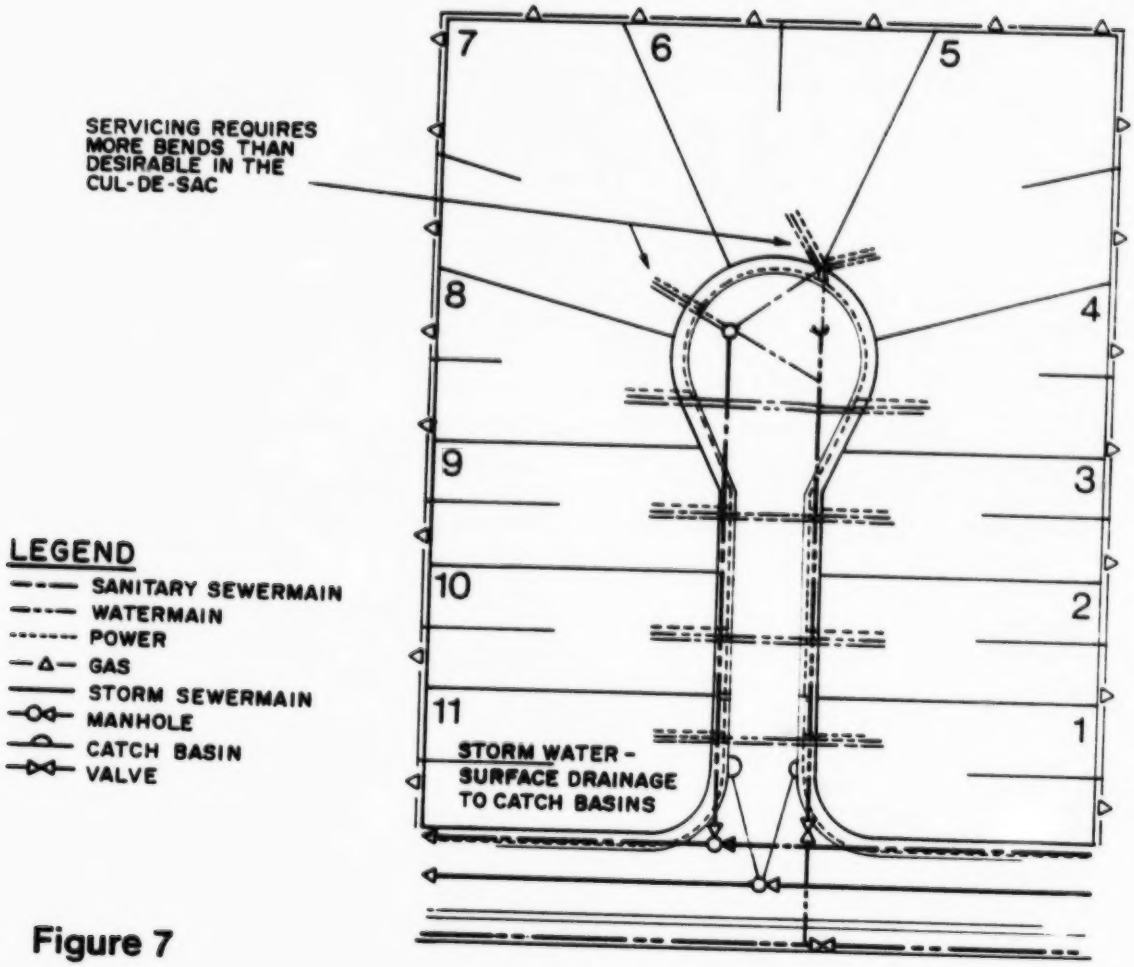

Figure 7

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2.4 Summary

The typical cul-de-sac provides many desirable urban design features.

The cluster of houses on a quiet residential street creates a very desirable living environment. The larger lots are suited to those families and individuals desiring more outdoor living space. The cul-de-sac also provides a variety of lot sizes from conventional rectangular-shaped lots to larger pie-shaped lots. During the design process, it is sometimes possible to combine the privacy of the cul-de-sac with the benefits of an adjacent park, lake, or golf course.

The benefits of the cul-de-sac are offset by some potential problems.

The siting of houses, the inefficient use of front yard and side yard spaces, the crowding of road paving and driveways, off-street parking, and a lack of on-street parking spaces pose serious constraints to the urban environment of the cul-de-sac. There are also some servicing difficulties, such as bends in sewer service connections, and dead-end watermains which allow reduced fire flow, increased sedimentation and a potential for freeze-up. Large moving vans and service vehicles have trouble turning around within the paved area. In addition, the choice of house design for a prospective homeowner is limited by the wedge-shape of the lot, the setback constraints and to some degree the siting of houses on adjacent lots.

An assessment of these inefficiencies and siting problems has resulted in recommending an alternative design for a cul-de-sac. The alternative design is more fully illustrated and discussed in Phase II of this study. Phase II also contains a comparison between the conventional and the alternative cul-de-sac design.

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AN ALTERNATIVE CUL-DE-SAC DESIGN

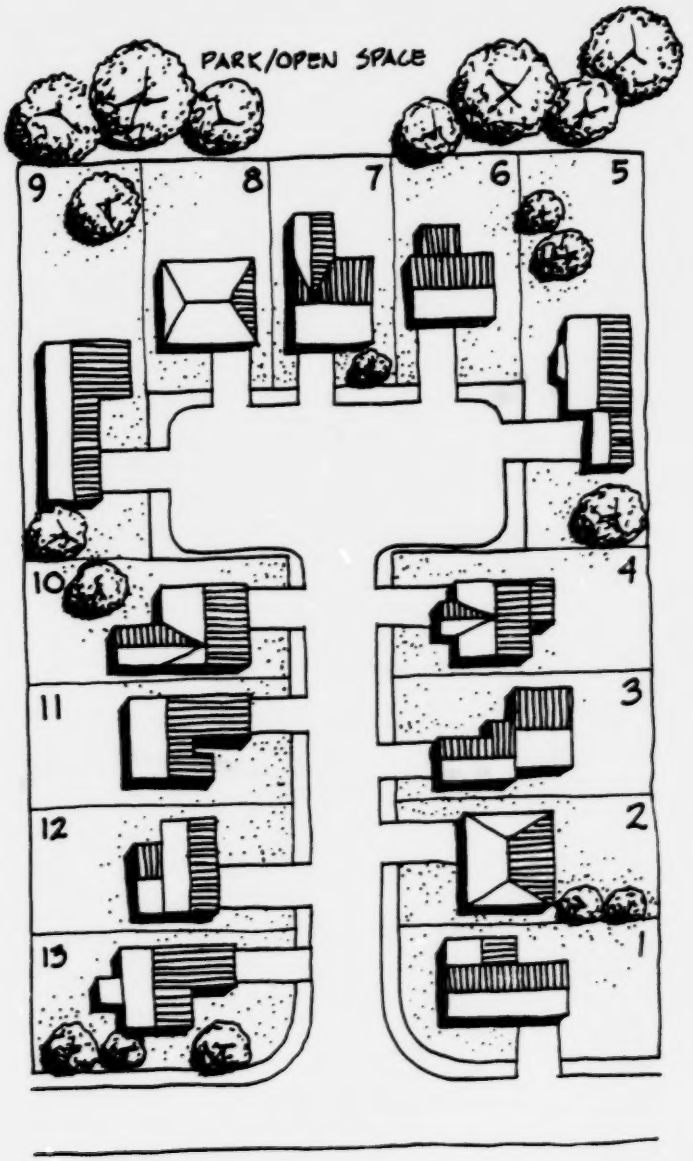

Figure 8

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3. PHASE II - REVIEW OF A SUITABLE ALTERNATIVE TO THE CONVENTIONAL CUL-DE-SAC

In Phase I of this report a brief examination was conducted of conventional cul-de-sac design and its positive and negative features were enumerated. As well, the municipal servicing and design requirements were reviewed and commented upon.

In this phase an alternative design for a cul-de-sac is reviewed with a specific attempt to overcome some of the negative features of the conventional design without losing any of the positive advantages.

3.1 Problems Associated With a Conventional Cul-de-sac Design

Problems associated with the conventional cul-de-sac stem largely from the necessity to create a turning area for vehicles on a dead-end street. The solution traditionally has been to create a circular paved area at the end of a short street which gives the right-of-way and roadway of the cul-de-sac its characteristic "key-hole" shape. Municipal Land Use Bylaws define lot width and lot depth, front and side yard requirements, and determine shape of lots which front onto the right-of-way. Lots which front onto the straight portion of the right-of-way have a rectangular shape while lots on the curved portion of the right-of-way tend to be pie-shaped.

When siting a house on a pie-shaped lot, the side yard setbacks and the width of the house determine the depth of the front yard and backyard space. If a wide house is chosen, it will be sited further back on the lot creating a deeper front yard and consequently a shallower rear yard. Regardless of how a house is sited on the pie-shaped lot, inefficient space will always occur in the side yard areas. See Fig. 9

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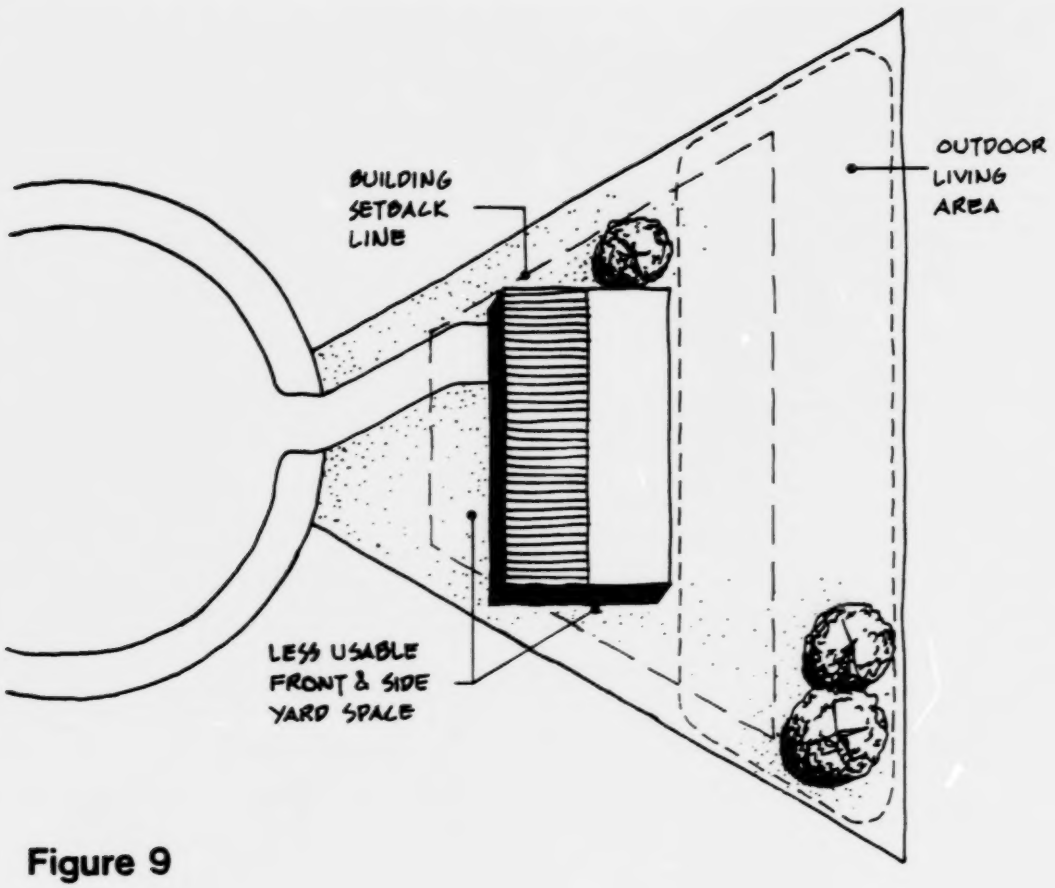

Figure 9

By comparison, when siting a house on rectangular-shaped lots the house can be moved to the front lot line and/or situated parallel to the side yard setback lines. This siting arrangement makes maximum use of the buildable areas and permits maximum use of outdoor living space in the backyard. Fig. 10 illustrates a siting arrangement for a rectangular lot.

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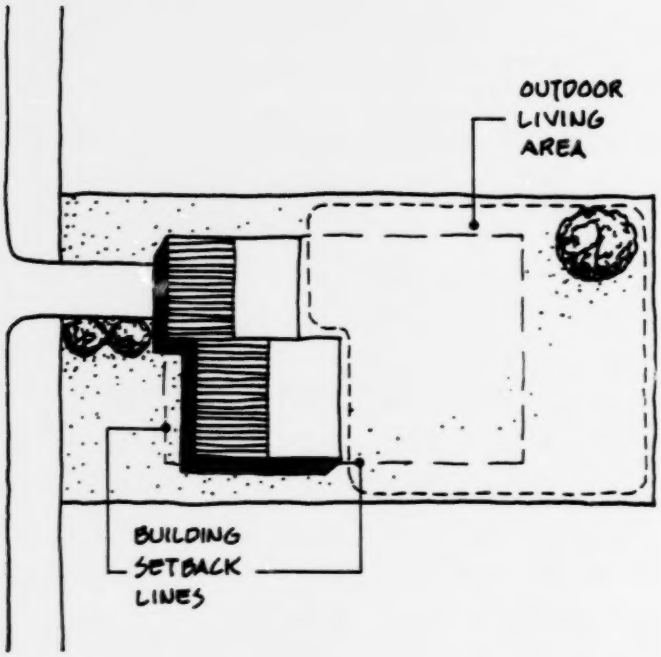

Figure 10

When lots are created using the same bylaw requirements for lot width and depth, pie-shaped lots will have a greater lot area and net developable area than a rectangular-shaped lot. However difficulties in siting a house and the inefficient front and side yard areas make the pie-shaped lot, at times, less functional. Use of the rectangular-shaped lot where possible can increase efficiency in the use of land available.

When cul-de-sacs back onto open space or amenity areas, the desire to provide as many lots actually adjacent to this space becomes important. The alternative design described below is a result of attempts to achieve this advantage.

3.2 Alternative Cul-De-Sac Concept

The alternative cul-de-sac concept illustrated by Fig. 8, has been designed to retain the desirable features of the conventional cul-de-sac. These are:

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- that the dead-end roadway prevents through traffic,
- that the arrangement of lots and houses gives the feeling of privacy, security and a sense of community, and
- that there are larger lots for those who prefer more outdoor living space.

By comparison, the space around the cul-de-sac head can now be designed for:

- better access to off-street parking,
- better on-street parking,
- more efficient servicing and therefore fewer maintenance problems,
- potentially better use of available land in the wider sense (more lots per acre),
- better use of land within each lot,
- more flexibility in house design,
- better urban design to the cul-de-sac head, and
- a greater number of lots back onto the amenity space combining, therefore, the elements of privacy and seclusion of the cul-de-sac with the benefits of the amenity area.

3.3 Comparing The Conventional and Alternative Cul-De-Sac Design

Fig. 11 illustrates the conventional cul-de-sac and the alternative design. The table of statistics provides a comparison of both designs. Major differences between the designs are:

- the alternative cul-de-sac is slightly larger in area as the length is greater while the width is less. The variance in overall area is less than the size of one lot, while the alternative design produces two additional lots.
- the area of the roadway and right-of-way is greater in the alternative design, and therefore net developable land area is less than in the conventional design,

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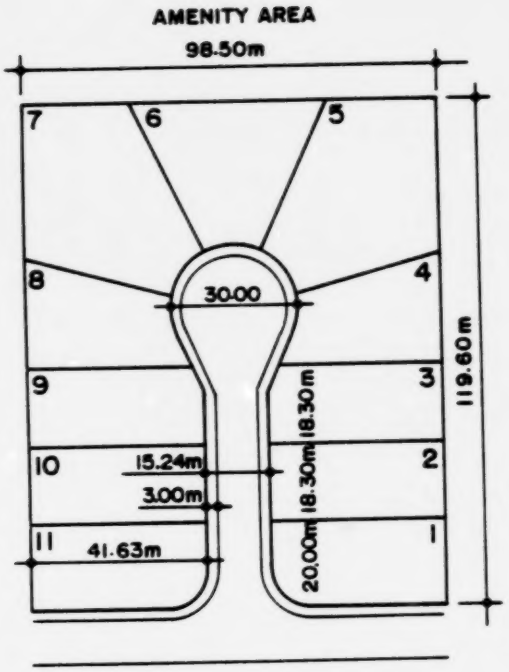
- five lots back onto the amenity area in the alternative design, while in the conventional design only one lot has full orientation and access to the amenity and two other lots have partial orientation and access to it.
- corner lots, 5 and 9 in the alternative design have less area but a more efficient shape than lots 5 and 7 in the conventional design.

CONVENTIONAL



ALTERNATIVE

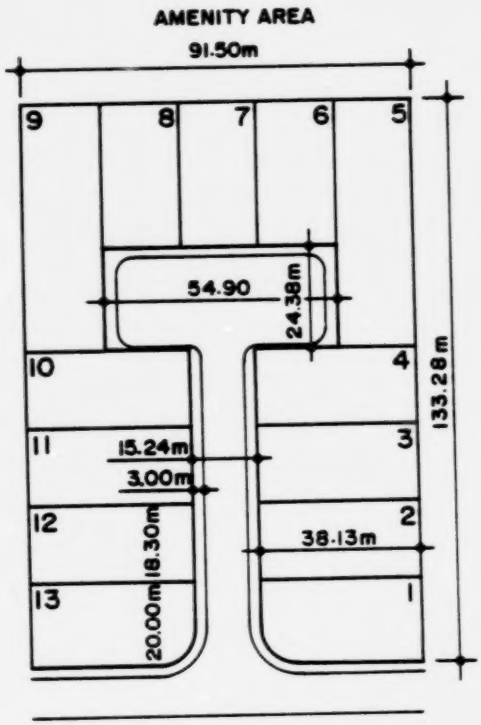


Figure 11

	Conventional	Alternative	Variance
Total Area	11780.6 sq. m.	12195.12 sq. m.	+414.5 sq. m.
Area of Right-of-Way	1584.0 sq. m.	2480.0 sq. m.	+896.0 sq. m.
Net Residential	10196.6	9715.12	-481.5
Pavement Area	1024.0	1737.6	+713.6
No. of Lots	11	13	+ 2
No. of Lots Backing onto Amenity	3	5	+ 2
Area of Corner Lot No. 5	1400.0 sq. m.	1068.4 sq. m.	-332.0 sq. m.

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Land Use Bylaw requirements, municipal right-of-way and road standards for the Town of Spruce Grove were used to determine dimensions of lots, rights-of-way and roadways. Dimensions of the roadway and right-of-way in the alternative cul-de-sac are based on research conducted by Reid, Crowther & Partners Limited. These dimensions may change from one municipality to another depending on local standards.

3.4 Site Planning and House Orientation

Several factors should be considered when siting houses on lots within the alternative cul-de-sac. They are:

- the relationship between the corner lots and the orientation of the houses to the outdoor space.
- a suitable floor plan and house orientation.
- setback distances and windows.
- fencing and screening.

Fig. 12 on the following page illustrates a method of siting houses on lots 8, 9 and 10 of the alternative design.

SITE PLANNING & HOUSE ORIENTATION

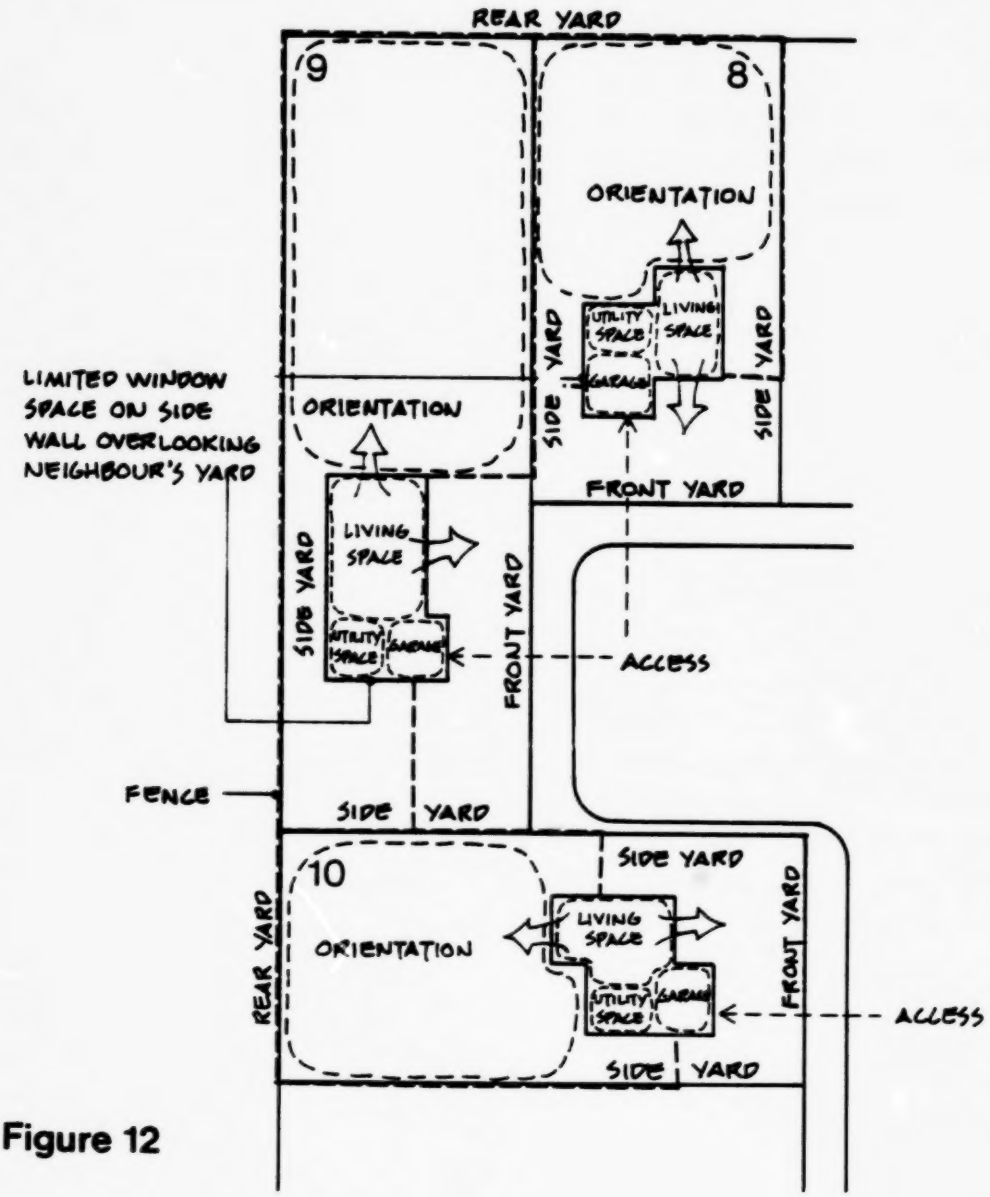

Figure 12

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The first consideration in site design is the selection of the most desirable floor plan to best suit the lot. In addition, when choosing a house for a particular lot, careful consideration should be given to the relationship between the internal and outdoor functions and outdoor spaces. Indoor living areas such as the living room, dining room, and kitchen should be located adjacent to active outdoor living spaces. Bedrooms should be in quiet areas of the house and ideally, utility areas such as laundry rooms and garages should buffer indoor living areas from the street and neighbouring yards. The floor plan selected for houses sited on lots 8, 9, and 10 should adhere as much as possible to these design principles. Lots 5 and 9 are particularly susceptible to visual intrusion from adjacent lots. The windows of habitable rooms such as living rooms, kitchens and dining rooms should not overlook a neighbour's yard or be opposite a window of a habitable room in an adjacent house.

The setback distance between houses should be determined by the relationship of the activities which occur inside the house and the activities in the adjacent outdoor spaces. The more active areas such as living rooms and kitchens which have large windows, should have a greater setback and the corresponding lot areas defined as front and rear yards. The lot areas which are adjacent to utility areas, garages and bedrooms, should be defined as side yards.

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3.5 Municipal Servicing and Maintenance of the Alternative Cul-De-Sac

Municipal servicing standards for the alternative cul-de-sac are similar to other residential streets and to the conventional cul-de-sac. However, there are some differences in the methods of servicing and level of maintenance. There may not be storm sewer in the right-of-way if the cul-de-sac is short and topography is suitable. Stormwater could be carried via gutters to the catch-basin at the intersection in the same manner as in the conventional cul-de-sac. Individual lots can be serviced by connections to services in the right-of-way. Water lines servicing the cul-de-sac would be dead-ended. If municipal standards require that waterlines be looped from one cul-de-sac to another where a series of cul-de-sacs occur, the 65-100 meters of watermain required for a conventional system could be reduced to 30 - 50 meters for the alternative system with a less restrictive easement requirement. Looped watermains between cul-de-sacs has not been taken into consideration in this report.

Maintenance vehicles would have sufficient area to maneuver within the paved portion of the alternative cul-de-sac and larger vehicles such as moving vans would have space to make a three point turn rather than having to back down the street as in a normal cul-de-sac.

A servicing concept for the alternative cul-de-sac is illustrated by Fig. 13.

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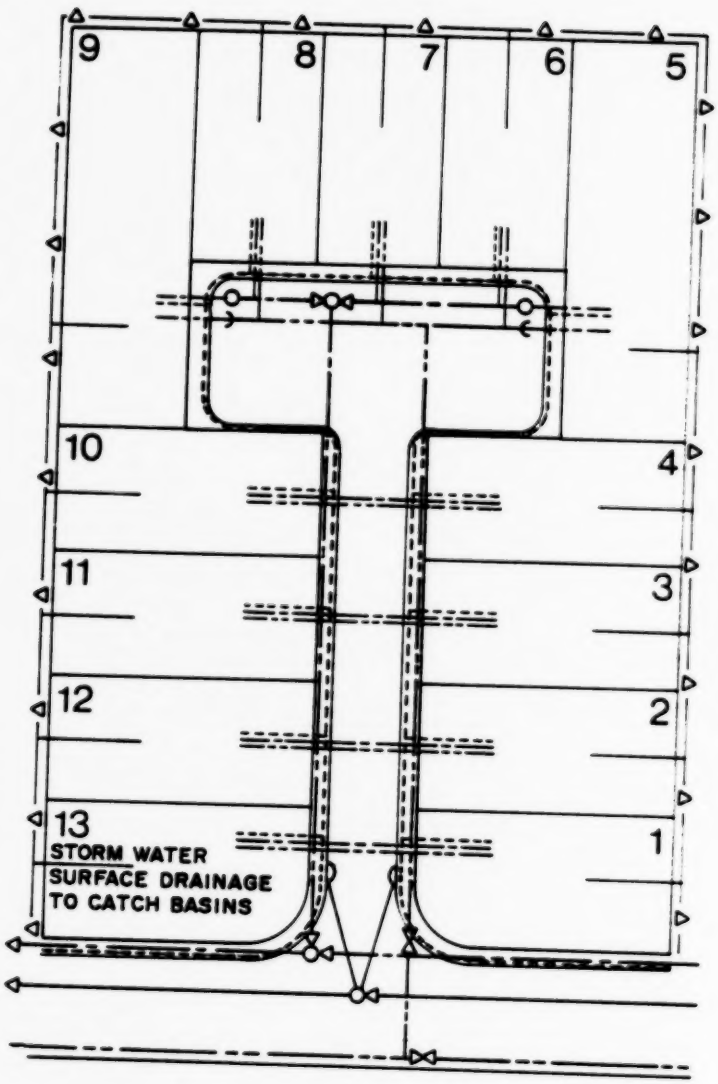
MUNICIPAL SERVICING



LEGEND

- SANITARY SEWERMAIN
- WATERMAIN
- POWER
- GAS
- STORM SEWERMAIN
- MANHOLE
- CATCH BASIN
- VALVE

Figure 13

...../25

3.5.1 Municipal Servicing*

Municipal Services* Within Cul-de-sac	Conventional - 11 lots	Alternative - 13 lots	Variance
1. Watermain	93 m	155 m	+ 62 m
2. Sanitary	78 m	143 m	+ 65 m
	1 manhole	3 manholes	+ 2
3. Storm	2 catchbasins	2 catchbasins	-
	2 catchbasin leads	2 catchbasin leads	-
4. Sanitary Servicing trench	90 m	61 m	- 29 m
5. Water Servicing Trench	33 m	28 m	- 5 m
6. Water line connection	11	13	+ 2
7. Sanitary service connection	11	13	+ 2
8. Pavement	1210 m^2	1810 m^2	+ 600 m^2
9. Curb & Gutter	210 m	300 m	+ 90 m
Services Within Adjacent Road			
10. San, Water, Storm	98.5 m	91.5 m	- 7 m
11. Pavement, curb and gutter	98.5 m	91.5 m	- 7 m

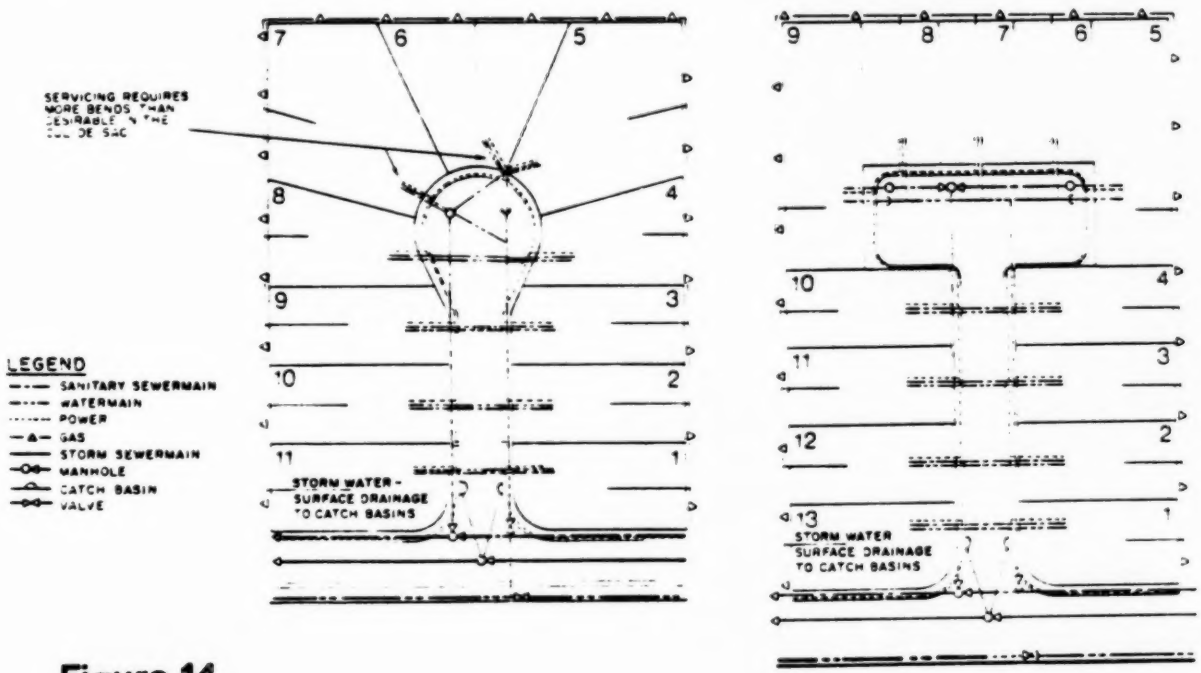


Figure 14

* Municipal services do not include power, street lights, pregrading, lot grading and hydrants.

3.5.2 Municipal Servicing & Maintenance

Municipal servicing standards for the alternative cul-de-sac are similar to the conventional cul-de-sac design. Fig. 14, illustrates servicing concepts for both designs and the chart provides a comparison of the length of services for the cul-de-sac and adjacent road right-of-way.

A comparison of the servicing and maintenance requirements for both cul-de-sacs is provided below.

Service	Conventional	Alternative
1. Lot Grading	No change to conventional manner of lot grading would occur.	No change to conventional manner of lot grading would occur.
2. Natural Gas	The same method of servicing is used.	The same method of servicing is used.
3. Power Distribution	Shorter length of powermain but fewer lots. 18.7 m per lot.	Longer main length but greater number of lots. 22.6 m per lot
4. Street Lighting	Possible one lamp standard required per cul-de-sac.	Possible two lamp standards required.
5. Storm Drainage	a) When surface drainage flows to the head of the cul-de-sac one catchbasin is normally required.	When surface drainage flows to the head of the modified design, two catchbasins would be required.
	b) Standard stormwater management system used.	Greater number of lots increase coefficient of runoff which result in larger stormwater management facility requirements.

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Service	Conventional	Modified
6. Water-mains	a) Shorter watermain length 8.5 m, per lot.	Longer watermain, 11.9 m per lot.
	b) One dead end watermain servicing two lots.	Two dead end watermains each servicing two lots.
	c) Fewer lots on minimum size watermain which is inefficient.	More lots on minimum size watermain which is more efficient.
7. Sanitary Sewers	a) Shorter, but fewer lots serviced by minimum diameter pipe.	Longer, but more lots serviced by minimum pipe increasing efficiency.
	b) 1 manhole required.	3 manholes required.
	c) When 3 lots are serviced into one manhole, there is sometimes insufficient flow resulting in freezing and plugging at the high end of the system.	When 5 lots, are serviced through two lateral mains, the potential for freezing and plugging of mains would be reduced.
	d) At the upper end of the system, service lines are at awkward angles, using up maximum allowable degree of bend even before builders tie into the system. These hook-ups are longer and more prone to problems.	The alignment of services is parallel to lot lines and perpendicular to mains, therefore more flexibility allowed to the builder. The lines from the main to the house would be shorter and less prone to problems.
8. Pavement Area	a) Less pavement is required, 110 m^2/lot	More pavement required, 140 m^2/lot.
	b) Service connections from the manhole to the lot line are located under a large expanse of asphalt which is susceptible to trench settlement.	There is a shorter distance from the laterals to the lot line which means only a short distance would be susceptible to settlement.

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Service	Conventional	Alternative
9. Major Arterials, Trunk sewer and water lines.	11 lots per cul-de-sac	13 lots per cul-de-sac will increase densities in the catchment area which will require larger trunk and support services.
10. Service Vehicles	Smaller service and maintenance vehicles can maneuver within the turning area, but larger vehicles must back up to get out of the cul-de-sac.	Small service vehicles would have sufficient room to maneuver. There would be more room for vehicles to maneuver and make a three point turn to exit driving forward.
11. Snow Storage and Removal	Angled driveways leave little room for snow storage.	Snow clearing and storage more convenient due to fact that driveways are parallel to lot lines and perpendicular to right-of-ways.

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3.5.3 Estimated Costs for Municipal Services

The following chart lists the estimated costs for servicing the conventional and modified design and compares the costs on a per lot basis for the services located within the cul-de-sac.

Comparison of Costs

Item	Conventional	(11 lots)	Alternative	(13 lots)
1. Watermain	97 m @ $75	7,300	150 m @ $75	11,300
2. Sanitary	78 m @ $60	4,680	143 m @ $60	8,580
	1 MH's @ $1,050	1,050	3 MH's @ $1050	3,150
3. Storm	2 CB's @ $ 900	1,800	2 CB's @ $ 900	1,800
	CB leads	1,980	CB leads	1,980
4. San. Service Tr.	90 m @ $45	4,050	61 m @ $45	2,745
5. Water Serv. Tr.	33 m @ $45	1,485	28 M @ $45	1,260
6. Service Con. W.	11 conn	3,230	13 conn.	3,340
7. Service Con. San	11 conn	848	13 conn.	688
8. Pavement	1210 m ^{2}	22,990	1810 m ^{2}	34,500
9. Curb & Gutter	210 m	7,350	300 m	10,500
TOTAL		$56,763		$79,848
Per Lot Cost		$ 5,160		$ 6,141

The cost for servicing a lot in the alternative cul-de-sac is approximately $1,000.00 per lot greater. However, the alternative design is 91.4 m in total width while the traditional is 100 m wide. Therefore, the adjacent services and the adjacent roadway would be correspondingly less for the alternative design. The estimated cost of the adjacent roadway and services in both designs is illustrated in the following table.

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Item	Conventional Cul-de-sac	Alternative Cul-de-sac
Total Length of Adjacent Road	98.5 m	91.5 m
Sanitary, water, storm	$28,400.00	$25,900.00
Pavement, Curb and Gutter	$27,170.00	$24,450.00
TOTAL	$55,570.00	$50,350.00
Cost per lot	$ 5,052.00	$ 3,873.00

If the cost of servicing both cul-de-sacs is combined with 50% of the cost of the adjacent roadway and services, the per lot cost is comparable as illustrated below.

Total Servicing Cost Per Lot

	Conventional	Alternative
Per lot costs	$5,160.00	$6,141.00
Per lot costs for 50% of the adjacent roadway and services	2,526.00	$1,937.00
Total	$7,686.00	$8,078.00

This represents about a 5% increase ($7,686 to $8,078) per lot for servicing between the Conventional and the Alternative cul-de-sac design, against an 18% increase (11 lots to 13 lots) in the number of lots, or a 66% increase in the number of premium lots (3 lots to 5 lots).

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3.6 Recovery Costs

It would be inaccurate to compare the two cul-de-sacs on the basis of servicing costs alone. The acquisition and resale of land has to be considered. In this general area comparisons become very difficult in that land can be bought and held for many years resulting in an artificial comparison when the time comes for its resale. The assumption is made therefore to compare average costs for undeveloped and developed land in the Spruce Grove area based on 1982 dollars.

In addition, some general assumptions are made regarding the relative value of lots within a subdivision, i.e., lots on a cul-de-sac tend to sell for a higher value than lots located on through streets.

Thus, the following table draws comparisons between the conventional and alternative cul-de-sac designs.

The basic assumptions made are:

- that undeveloped residential land in Spruce Grove costs $35,000.00 per acre or $86,500.00 per hectare.
- that the price of an average serviced lot in Spruce Grove (15 x 36.5 m) is $33,000.00.
- that the lots at the end of a cul-de-sac sell 1 - 2% higher than the average lot.
- that lots fronting onto an amenity - such as the golf course, as well as being at the end of a cul-de-sac, sell 15 - 30% higher price than the average lot.
- that $5,000.00 per lot covers consulting fees, surveying costs, advertising, off-site levies, other levies and administration costs. Discussions with developers indicates this may be low.
- that all prices are in 1982 dollars.

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With these assumptions the costs were applied to the conventional and alternative designs.

	Conventional	Alternative
Area	1.42 Ha	1.45 Ha
Cost of land $86,500/ha	$122,830.00	$125,425.00
Cost to service (see above)	84,546.00	105,014.00
Other costs (consulting advertising, off-site levies, etc., $5,000/lot)	55,000.00	65,000.00
	$262,376.00	$295,439.00
Resale of lots	$386,000.00	$456,000.00
	$123,624.00	$160,561.00

On this basis the alternative design would have an increased profit margin of $36,937.00. If this was applied to each of the 13 lots there could be a saving of approximately $2,800.00 per lot or 8%.

In determining sale price for lots at the head of a cul-de-sac it is important to develop an understanding of how these prices are arrived at. In a conventional design an average 15 mx 36.5 m lot (547.5 sq. m) would sell for $33,000.00 or $60.27 per square metre.

A pie-shaped lot at the head of a cul-de-sac would be more than 547.5 square meters in area. However, the $60.27 per sq. m. would not apply to the area over 547.5 sq. m. As a general rule the area in excess of 547.5 sq. m would be priced at about 20% of this $60.27 figure or $12.00 per square metre. Thus, a 750 sq. m lot would sell for:

547.5 sq. m x $60.27 = $32,998.00
202.5 sq. m x $12.00 = $ 2,430.00
TOTAL = $35,428.00

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A premium lot fronting onto a golf course would sell for $38 - $40,000.00 or 15 - 20% more than a lot not fronting onto that amenity.

Little extra value is gained from the increased area of the pie-shaped lot.

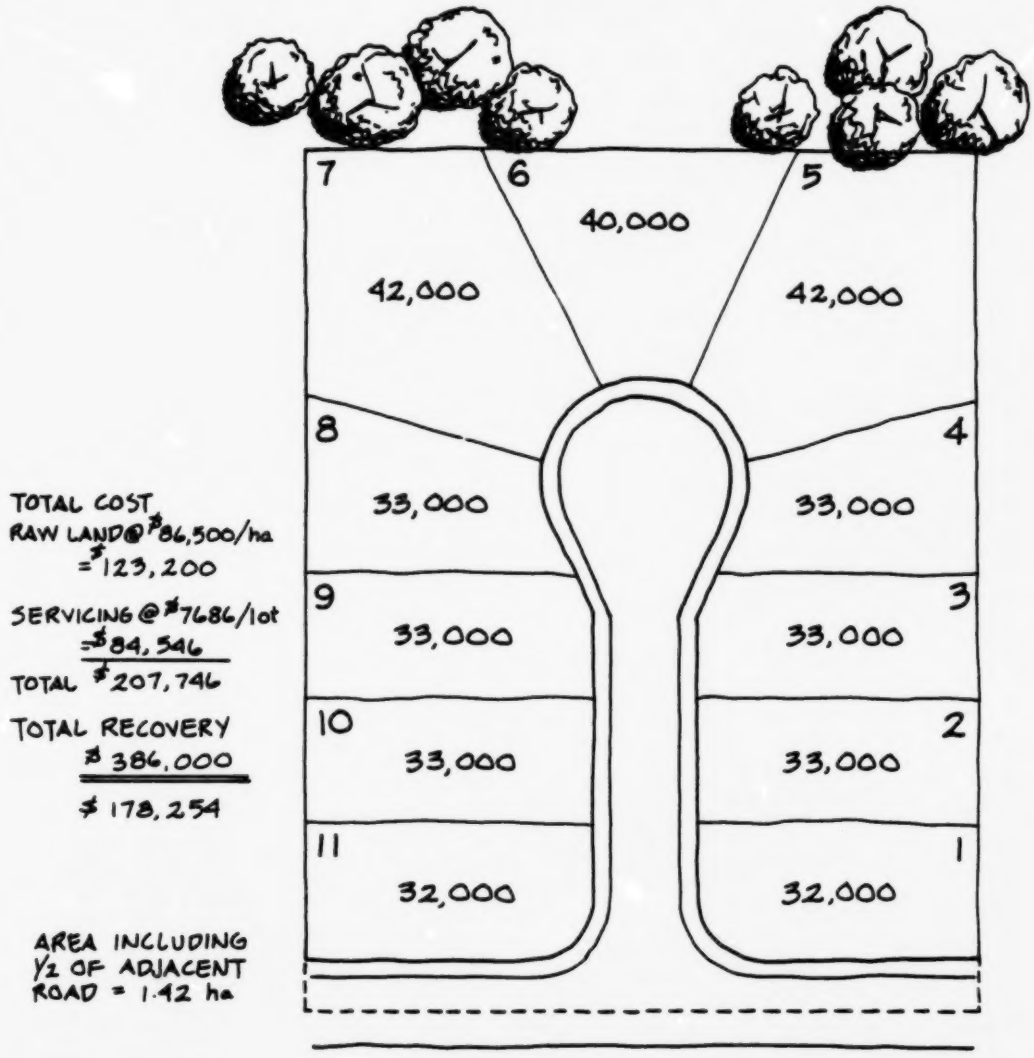

Figure 15

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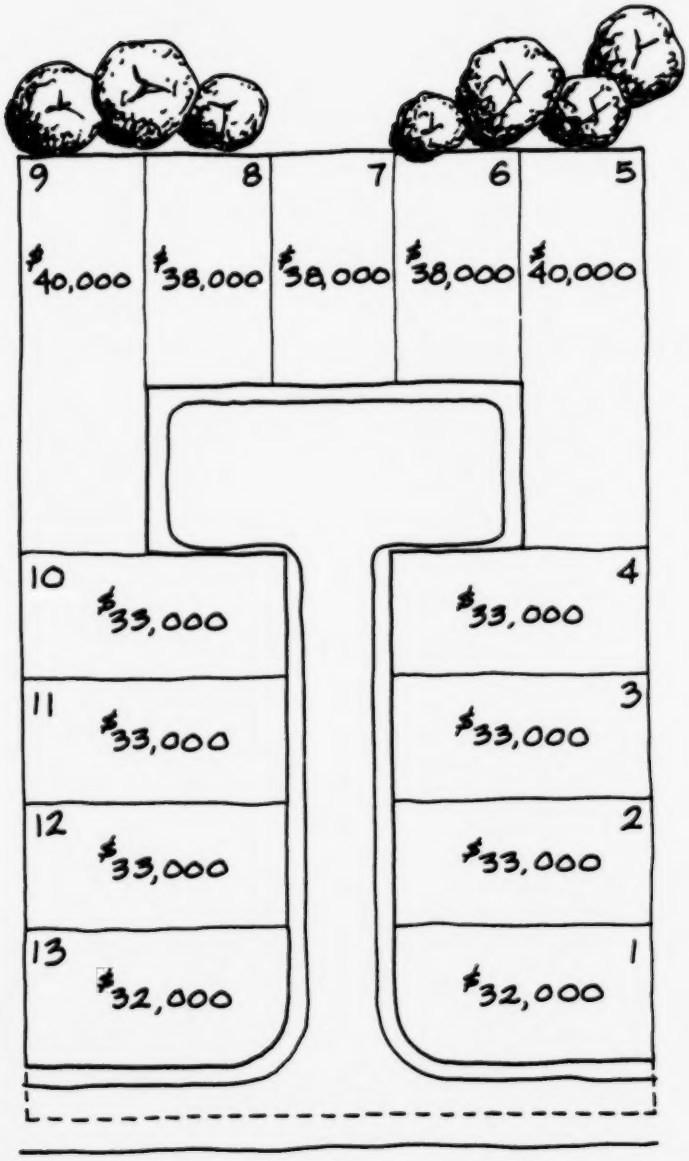

TOTAL COST
RAW LAND @ $86,300/ha
= $125,260

SERVICING @ $8078/lot
= $105,014

TOTAL $230,274

TOTAL RECOVERY
$456,000

$225,726

AREA INCLUDING
½ OF ADJACENT
ROAD = 1.45 ha

Figure 16

4. PHASE III - DEMONSTRATION PROJECT - CONCEPT DESIGNS

4.1 Introduction

Phase III of this report incorporates both the conventional cul-de-sac design and the alternative design as a subdivision design exercise, by applying the two approaches to an actual development area, and then comparing the two approaches.

The site to be used for this comparative exercise is one in the Town of Spruce Grove. The developers (Melcor Developments Ltd.) obtained approval of an Area Structure Plan for some six quarter sections of land to the north of the present developed portion of the Town. Proposed in this plan was an 18-hole golf course. The intention was to maximize the advantage of the amenity presented by the golf course by locating it as a continuous course threaded through the residential areas. This provided maximum frontage onto open space for future residents - an amenity many homeowners sought.

The golf course is now built and is operational. The next step is to develop a final subdivision within the spaces alloted, providing lots for sale to prospective home buyers.

A conventional subdivision was prepared in the preliminary stages of the design for the Area Structure Plan in order to ensure that both the golf course and the subdivision could be built. Now that the golf course is operational, a review of the subdivision has given rise also to a review of the efficiency of the conventional cul-de-sac. The cul-de-sac was used as a design solution for nearly all lots backing onto the amenity space. This opportunity for comparison has been made easy because the conventional design had already been prepared and was the basis for decisions made to proceed with the development of the golf course. Stringent economic times has resulted in a review of this form of development. Hence the current study.

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4.2 Description of the Site

The site chosen for this comparison is a 8.93 ha site located on the west side of the overall subdivision, sandwiched between three holes of the golf course. The site slopes gently towards the north and east and is currently used for agricultural purposes. There are no trees on the site thus eliminating one minor design constraint.

Requirements are that a major collector road circulate through the "Golf Course Subdivision". Thus, in the area under consideration, cul-de-sacs would be the only feasible design solution as the area is neither wide enough for loop roads nor narrow enough to permit direct frontage onto the collector road. This latter solution would also require a lane between the golf course and the residential lots, effectively destroying any amenity value derived by backing lots onto the golf course, as well as creating an undesirable function along the edge of the golf course.

4.3 Comparison Between Traditional and Alternative Design

Figures 17 and 18 on the following pages show graphically the comparison between the two different subdivisions. The figures included compare the financial implications of each design.

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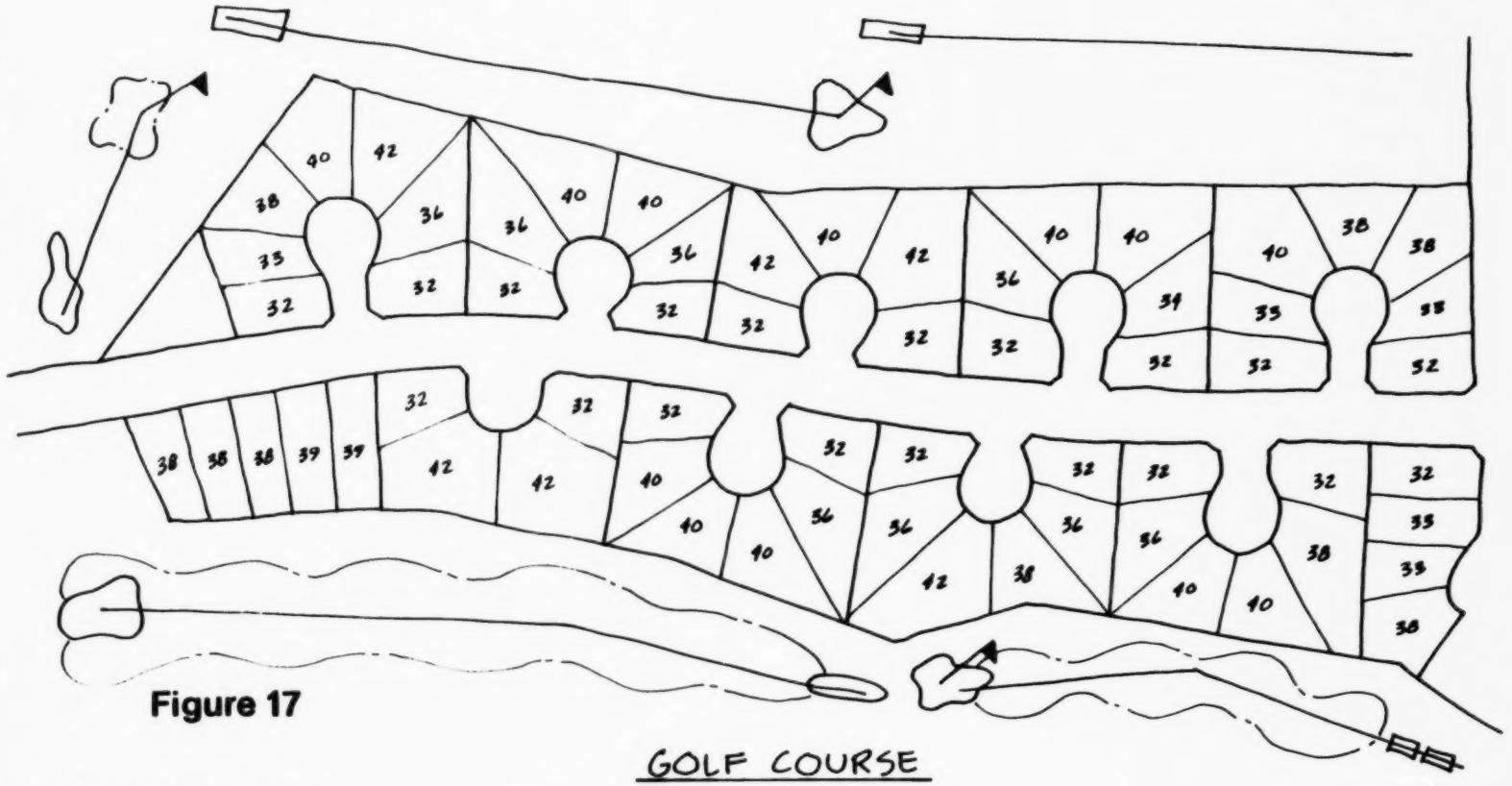

Figure 17

4.3.1 Conventional Design

Area	8.93 ha	Cost of land	
Number of lots	62	hectares x $86,500.00	$ 772,445.00
Area of lots	6.91 ha	Cost to service	
Average per lot	0.111 ha (1114 sq. m)	$7,686 per lot x 62	$ 476,532.00
Area of roadway	2.02 Ha	Other costs (consulting	
Number of lots backing	28	fees, levies, advertising,	
onto the golf course		etc.) $5,000/lot x 62*	$ 310,000.00
			$1,558,997.00
		Selling price for area	$2,247,020.00
			$ 688,023.00

Figure 18

4.3.2 Alternative Design

Area	8.93 ha
Number of lots	75
Area of lots	6.2 ha
Average per lot	0.083 (826.6 sq. m)
Area of roadway	2.73 ha
Number of lots backing onto the golf course	56
Cost of land hectares x $86,500.00	$772,445.00

Cost to Service $8,078 per lot x 75	$ 605,850.00
Other costs (consulting fees, levies, advertising, etc.) $5,000/lot x 75*	$ 375,000.00
	$1,753,295.00
Selling price for area	$2,803,000.00
	$1,049,705.00

* $5,000.00 is an assumed figure, discussions with developers indicate this may be low.

5.0 CONCLUSION

The conclusion of this study is:

- that under certain circumstances alternative forms of cul-de-sac design permits better urban design, better use of developable land, better access (more people) to potential amenity areas, higher density and better return on investment.
- that the conventional design is marginally (5% or less) less expensive to serve.
- that high density in the long run, and taken over a wider area could assist in more affordable housing. If the return on investment under the conventional system were retained as the maximum level of return, then the cost per lot under the alternative system could be lowered by $2 - $4,000 per lot or 5% to 10%.

POOR

QUALITY

ORIGINAL